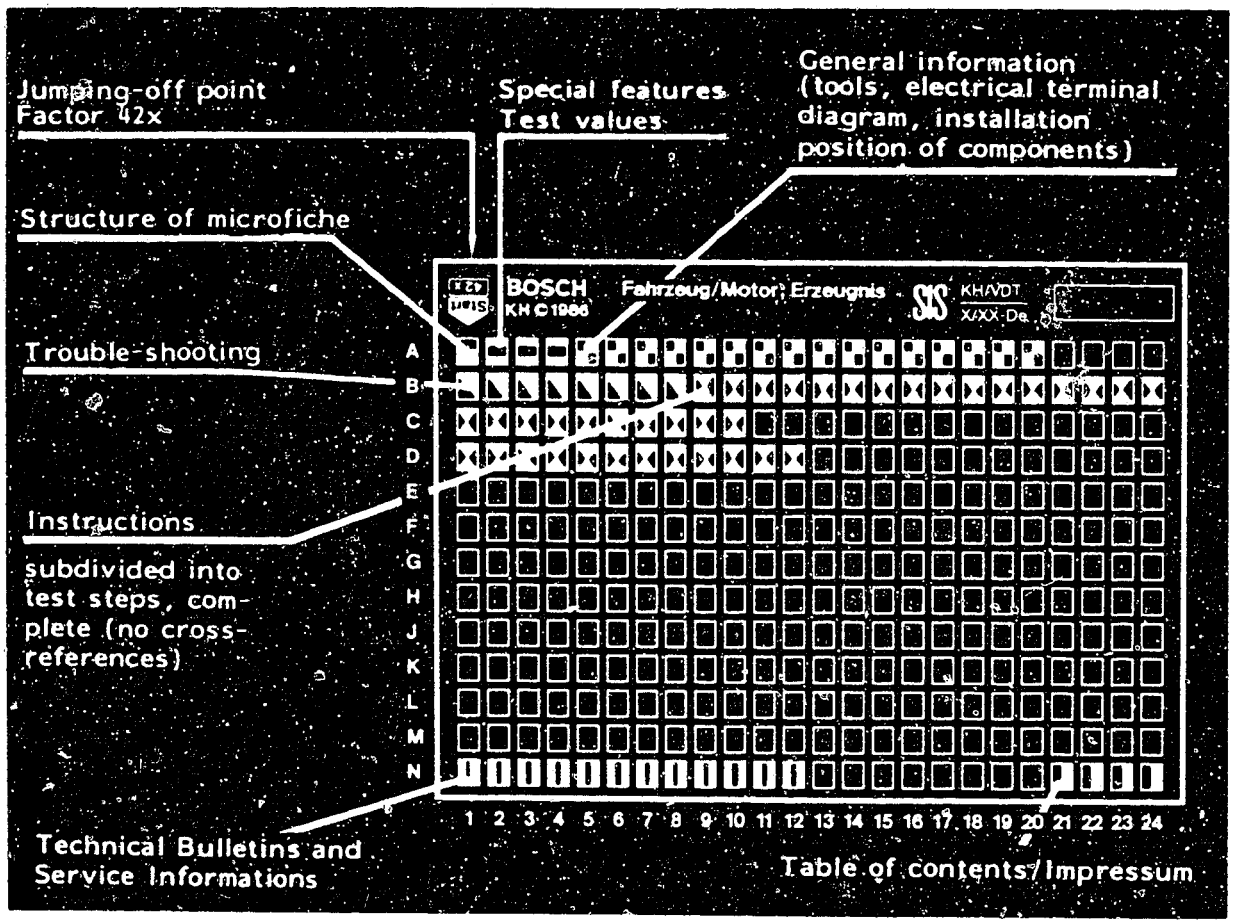
Structure of microfiche



1. Read from left to right

2. Title of microfiche (appears on each coordinate)

E16	Product/component/test step
	Vehicle/engine

Coordinate

3. Limits of section

Beginning | Mid-section | End | One-page section

4. References to relevant test steps in test specifications; coordinate e.g. C6

C6

A1	Trouble-shooting program	↓

1. Special features

This microcard applies to the Alfa Romeo Spider 2.0l, year of manufacture 1981, USA version with EI.

Vehicle is equipped with:

EI control unit	0 227 400 003 (with current limitation)
Ignition coil	0 221 122 026

2. Test specifications

B11

Ignition coil, primary	0.6...1.0Ω
Ignition coil, secondary	3.2...5.6kΩ

B17

Coolant-temperature sensor	+ 20°C	2.1...2.9kΩ
	+ 30°C	1.4...2.0kΩ
	+ 80°C	280...370 Ω
	+ 90°C	210...280 Ω
	+ 100°C	160...215 Ω

B19

Throttle-valve-switch idle contact

Idle position	approx. U_B
Throttle vale, open approx. 1°	0 V

B23

Vacuum sensor

Pressure drop per minute, max.	150 mbar
Insulation	∞Ω
Internal resistance	50 ... 60Ω

B17

Spark advance
(coolant temperature > + 60°C)

Idle spark advance with vacuum	6... 14° before TDC at 900 min^{-1}
Full-load spark advance without vacuum	12...20° before TDC at 2000 min^{-1}
Part-load spark advance with 300 mbar vacuum	26...34° before TDC at 2400 min^{-1}

C3

To avoid incorrect measurements, always test as per coordinate information.

C5

Ignition coil power supply with engine at idle	≥ 10 V

C7

Peak coil current cutoff approx. 1 s after ignition "ON"	0 V

C9

Primary voltage with engine at idle	300...410 V

D1

Voltage, EI control unit with ignition ON	U_B
Voltage, primary circuit with ignition ON	U_B

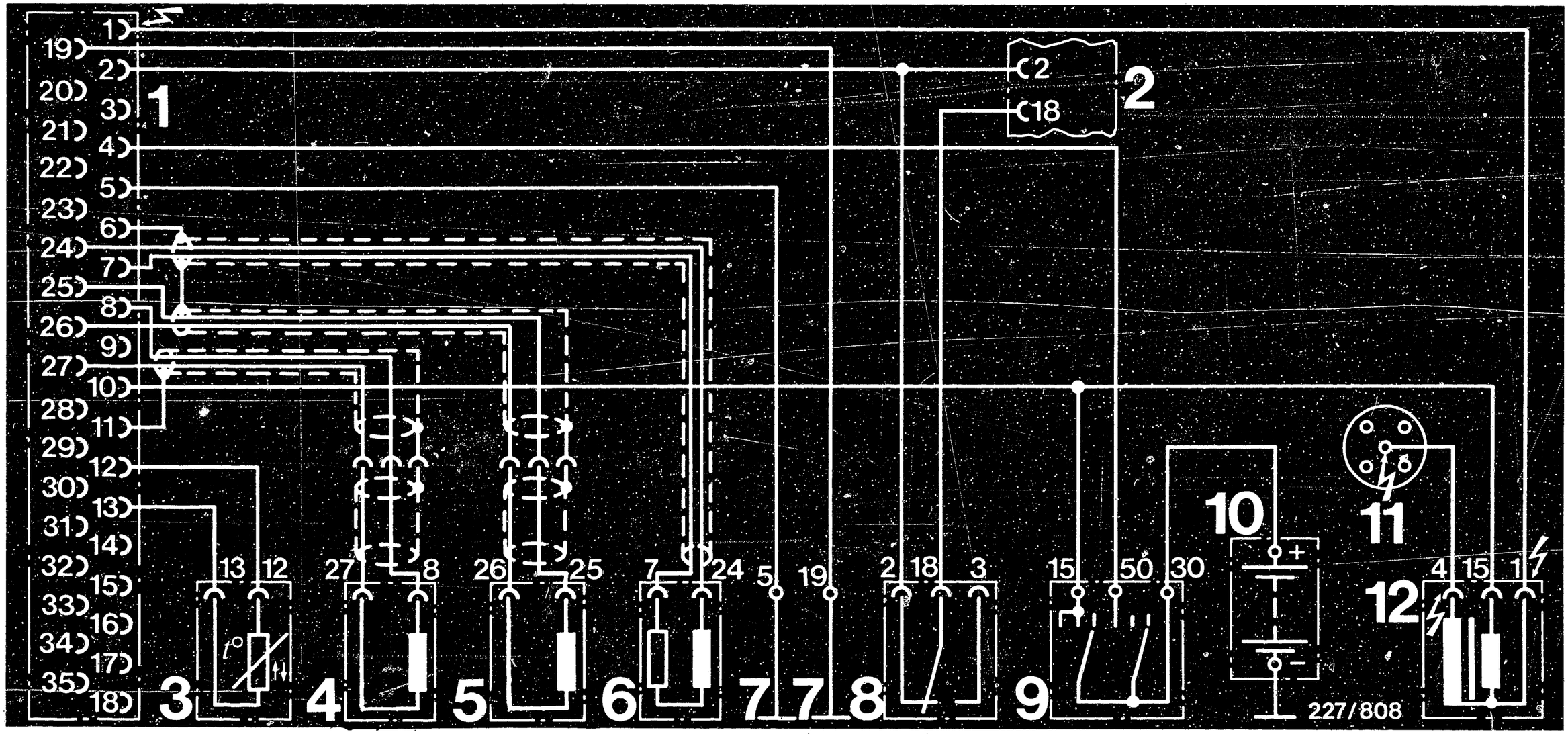
D3

Starting signal (terminal 50)	U_B
Engine-speed sensor insulation	$\infty\Omega$
Engine-speed sensor internal resistance	0.6...1.6 kΩ
Engine-speed sensor voltage (cranking speed > 200 min^{-1})	> 2.5 V

D7

Reference-mark sensor insulation	$\infty\Omega$
Reference-mark sensor internal resitance	0.6...1.6 kΩ
Reference-mark sensor voltage (cranking speed > 200 min^{-1})	> 2.5 V

See Autodata test specifications for settings for exhaust gas, valve clearance etc.



High-voltage symbols: Danger, 400 V ... 25 kV

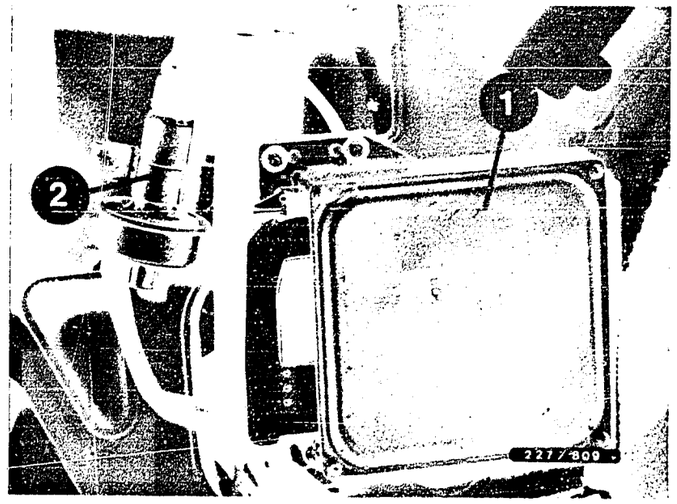
1 = EI control unit
2 = L-Jetronic control unit
3 = Coolant-temperature sensor
4 = Engine-speed sensor
5 = Reference-mark sensor
6 = Vacuum sensor
7 = Central ground (at intake manifold)
8 = Throttle-valve switch
9 = Ignition and starting switch
10 = Battery
11 = High-voltage distributor
12 = Ignition coil

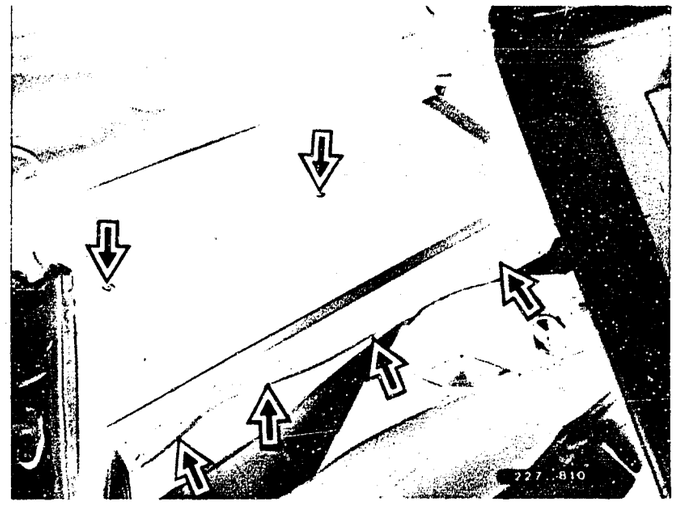
3. Electrical terminal diagram

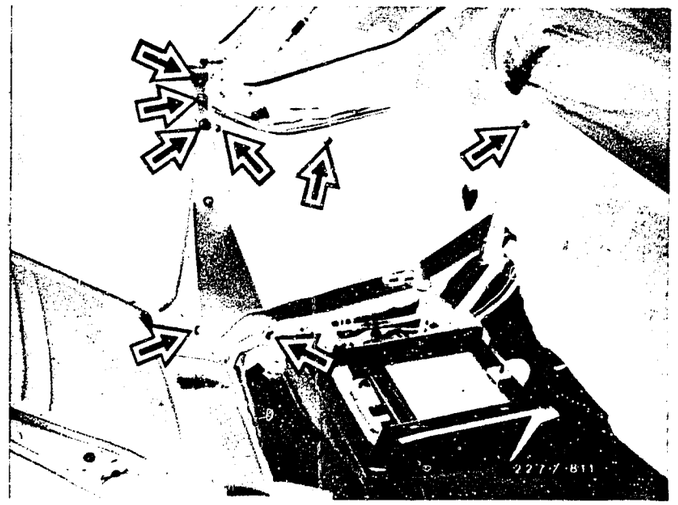
4. Installation position of components

EI control unit (upper illustration, pos. 1) or vacuum sensor (upper illustration, pos. 2) is positioned behind paneling.

Removal instructions
Tilt seat backrest forward.
Loosen hook and loop fastener of trunk floor, unscrew fastening screws. See center illustration, arrows.
Loosen screws from paneling (lower illustration, arrows).



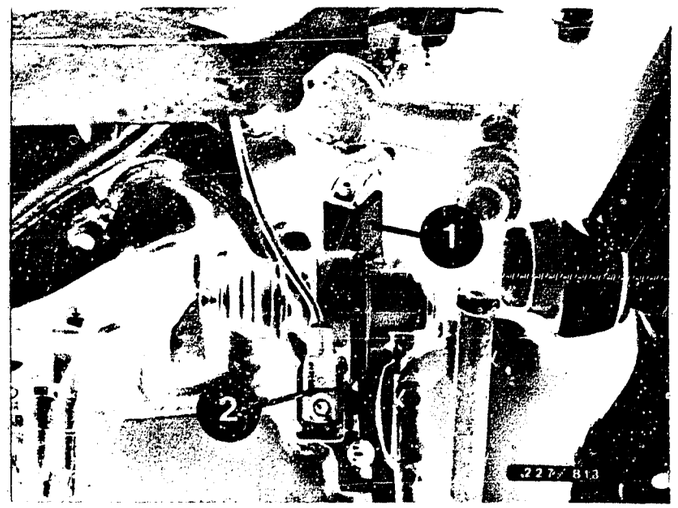




1 = Central ground
2 = Coolant-temperature sensor
3 = Throttle-valve switch

Engine-speed sensor and reference-mark sensor are positioned on the right of the clutch housing in the forward direction of travel.
See upper illustration.
Plug connection of engine-speed sensor and reference-mark sensor, see lower illustration, arrow.

Note: Plug of reference-mark sensor is gray.



1 = Engine-speed sensor
2 = Reference-mark sensor

Arrow = Plug connection of engine-speed/reference-mark sensors

5. Required testing and auxiliary equipment

Motortester, e.g.	MOT 201	0 684 000 201
Ignition-pulse-shaping circuit (required for measuring primary voltage at MOT 201, 202, and 400).		1 684 463 154
Spark gap, e.g. ignition-coil capacitor tester	EFAW 106 A	0 681 100 001
or simple spark gap	EF 1177/7	1 684 531 000
Sleeve-type suppressor 5 kΩ		0 356 500 001
Ohmmeter e.g.	ETE 014.00	0 684 101 400
or e.g.	Pontavi Wh2	commercially available
Voltmeter e.g.	ETE 014.00	0 684 101 400
Test leads (for proper connection of test equipment to plug connectors)		KDZS 0004
Test prod, black		1 684 485 034
Test prod, red (for expert connecting of testers to connectors)		1 684 485 035
Vacuum pump e.g. from Korinth Co. Ludwig-Kloos-Str. 21 D-6450 Hanau 7-Steinheim	Mityvac	Commercially available

6. Danger of accident on electronic ignition systems

Increased demands of modern engines on the ignition system combined with the desire for freedom of maintenance have recently led to electronic ignition systems being fitted as standard. Usually the ignition power of electronic systems (of almost all manufacturers) is higher than that of conventional systems, and there are signs of further increases in power. Electronic ignition systems thus reach a power range which can be highly dangerous if live parts of terminals are touched (both on the primary as well as the secondary sides).

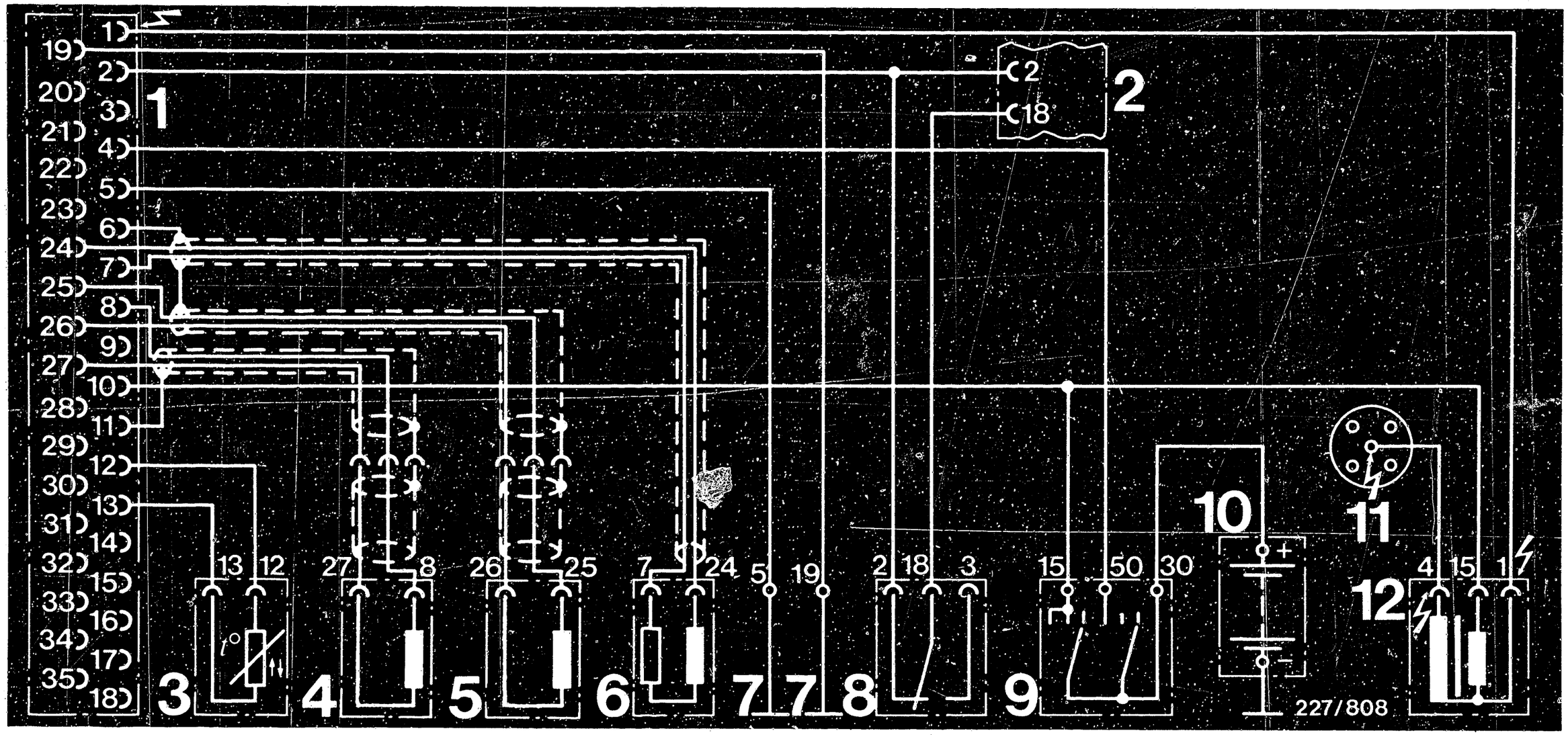
In this connection we should like to point out that the VDE regulations, in particular VDE 0104/7.67 and/or the respective national regulations must be followed when testing or working on the ignition system.

The ignition should always be switched off when working on the ignition system (switch off ignition or voltage source). Such work includes:

- Connecting of engine test equipment (timing light, dwell-tach tester, ignition oscilloscope etc.).
- Replacing parts of the ignition system (spark plug, ignition coil, ignition distributor, ignition cable etc.).

If it is necessary to switch on ignition (switching on or connecting ignition or voltage source) when testing the ignition system or undertaking engine adjustments (e.g. fuel induction), the hazardous voltages specified are present in the entire system.

The danger of accident exists, therefore, not only on the individual assemblies of the ignition system (e. g. ignition distributor, ignition coil, trigger box, ignition harness), but also on the wiring harness (e. g. tachometer connection, diagnostic plug), at plug-in connections and test equipment.



High-tension symbols: Danger, 400 V ... 25 kV

1 = EI control unit
2 = L Jetronic control unit
3 = Coolant-temperature sensor
4 = Engine-speed sensor
5 = Reference-mark sensor
6 = Vacuum sensor
7 = Central ground (at intake manifold)
8 = Throttle-valve switch
9 = Ignition and starting switch
10 = Battery
11 = High-voltage distributor
12 = Ignition coil

Electrical terminal diagram

The dangerous locations are marked with high-voltage symbols taking the example of the terminal diagram of an electronic ignition system.

7. Incorrect indication of engine speed, dwell angle and ignition point

In the case of an ignition system with EI control unit 0 227 400 003 (EI) with current limitation, there may be an incorrect indication of engine speed, dwell angle and ignition point on testers.

For further details see coordinates N 7 - N 11.

8. Important vehicle information

- Resistance measurements must be performed only with the ignition switched off or with the battery disconnected (risk of measuring instrument defect).

- In a compression test, firmly connect ignition coil terminal 4 to ground with an extra cable (dangerous high voltages, insulation damage at ignition coil, high-voltage distributor, ignition harness).

Note:
The auxiliary cable must be suppressed with at least 2 kΩ, e.g. with the interference suppression sleeve (5 kΩ) 0 356 500 001.

- The specified ignition coil (see Part No.) must not be replaced by another ignition coil.

- No suppression capacitor may be connected to ignition coil term. 1.

- Ignition coil terminal 1 must not be connected to ground as an anti-theft device (when the ignition is switched on, the ignition coil will be destroyed).

- No battery + or test lamp must be connected to ignition coil terminal 1 (EI control unit will be destroyed).

- High-voltage ignition cable from ignition coil terminal 4 to high-voltage distributor terminal 4 must not be disconnected during operation.

- Voltage flashover from ignition coil terminal 4 to ignition coil terminals 1 and 15 must not occur. EI control unit can be destroyed.

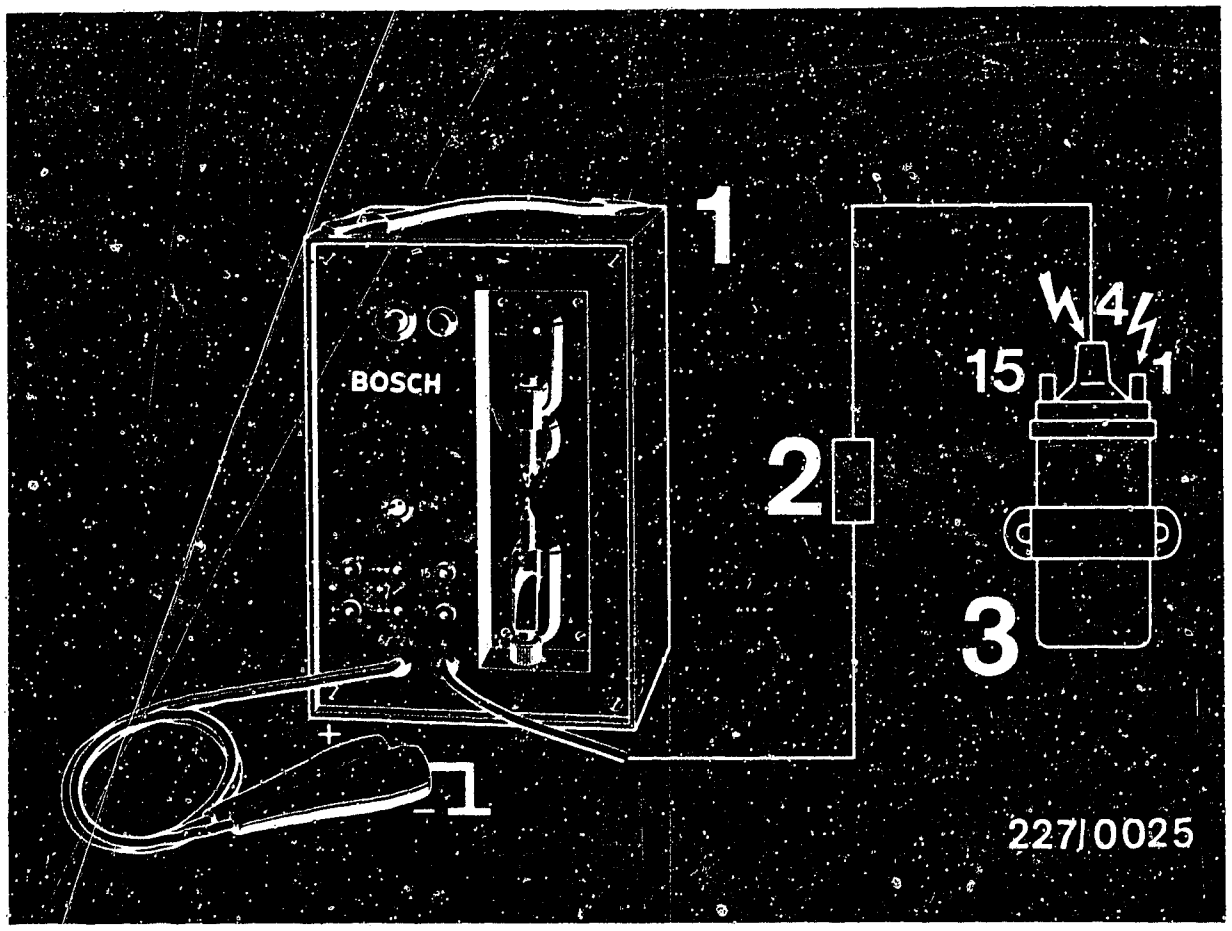
- To avoid destruction of the EI control unit, the secondary side of the ignition system must be interference-suppressed with at least 2 kΩ, whereby the original distributor rotor with 1 kΩ interference-suppression resistor must be installed (even in the case of radio interference-suppression and spark interference-suppression, do not use a 5 kΩ distributor rotor).

- Do not disconnect battery when engine is running.

- EI control unit and ignition coil will be destroyed if the battery has incorrect polarity.

- Do not use more than 16 V or a fast charger for starting assistance.

- Do not mix up the engine-speed sensor and reference-mark sensor connectors (pay attention to color coding).



1 = Spark gap
2 = 5 kΩ sleeve-type suppressor
3 = Ignition coil

High voltage arrows:
Caution, 400 V ... 25 kV

- In order to prevent the trigger box from being irreparably damaged, when using a spark gap, an interference-suppression resistor of at least 2 kΩ must be connected between the spark gap and ignition coil terminal 4, e. g. sleeve-type suppressor (5 kΩ) 0 356 500 001.

9. Trouble-shooting

9.1 Procedure - trouble-shooting chart

The trouble-shooting chart starting on Coordinate B 3 contains customer complaint (fault symptoms), cause of trouble, test instructions and coordinate reference.

The possible cause of the fault should be selected from the trouble-shooting chart in accordance with the customer complaint (fault symptom).

If the cause of the fault is not clear, start testing with the detailed, self-contained trouble-shooting program beginning on Coordinate B 7.

If the cause of the fault is clear from the trouble-shooting chart, direct trouble-shooting is possible by going to the stated coordinate without having to perform the entire trouble-shooting program for each fault.
If there is no coordinate reference, trouble-shooting must be performed in accordance with the "Test instructions" column.

9.2 Procedure - trouble-shooting program

The trouble-shooting program starting on Coordinate B 9 is divided into 3 rows of boxes.

The left-hand row contains test instructions and test specifications.

The center row contains repair instructions.

The right-hand row contains the illustrations/terminal diagrams belonging to the text and the explanations of the items in the picture.

If the questions asked in the left-hand row can be answered conclusively with "yes", then proceed to the next test down.

9.3 Before testing, make sure of the following:

Battery fully charged, fuel system O.K., eggine mechanically O.K. (e. g. compression, valve clearance etc.). Ambient temperature/ignition system temperature 0^{o} to 100^{o} C (temperature has a considerable effect on measured values).

9.4 Trouble-shooting chart

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start	2. Rough idling	3. Poor throttle response	4. Engine lacks power	5. Misfiring	6. Fuel consumption too high	7. Engine pings when accelerating	8. Backfiring	9. Engine becomes too hot	Cause of trouble	Test instructions	Coordinates
●	●	●	●	●	●	●	●	●	unclear	Carry out extensive trouble-shooting	B 9
●	●	●	●	●	●		●		Spark plugs defective	Assess using ignition oscillogram or remove spark plug and make visual examination	---
●	●	●	●	●					Shunt on secondary side	Assess ignition coil, high-voltage distributor, ignition harness and spark plug using ignition oscillogram or make visual examination	---
●	●	●	●	●					Open circuit on secondary side	Assess ignition coil, high-voltage distributor, ignition harness and spark plug using ignition oscillogram or test for continuity using ohmmeter.	---
		●	●	●	●				Interference-suppression resistors defective	Assess using ignition oscillogram or perform resistance measurement	---
●							●		Firing sequence incorrect	1-3-4-2	
●	●	●	●	●					Ignition coil defective	-	B 11

Trouble-shooting chart

Customer commplaint (symptom of trouble)

1. Starting motor operates, but engine fails to start	2. Rough idling	3. Poor throttle response	4. Engine lacks power	5. Misfiring	6. Fuel consumption too high	7. Engine pings when accelerating	8. Backfiring	9. Engine becomes too hot	Cause of trouble	Test instructions	Coordinates
●				●			●		High-voltage distributor setting incorrect	-	B 13
●									Contact resistance or EI control unit defective	-	B 15
						●			Coolant-temperature sensor defective	-	B 17
			●		●				Throttle-valve-switch idle contact defective		B 19
		●	●		●	●			Vacuum sensor (leakage, insulation, internal resistance) defective	-	B 23
●	●	●	●	●	●	●	●	●	Spark advance incorrect	To avoid incorrect measurement, always test as per coordinate information	B 17...C 3

Trouble-shooting chart

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start	2. Rough idling	3. Poor throttle response	4. Engine lacks power	5. Misfiring	6. Fuel consumption too high	7. Engine pings when accelerating	8. Backfiring	9. Engine becomes too hot	Cause of trouble	Test instructions	Coordinates
				●					Power supply to ignition coil (engine idling) defective	-	C 5
●									Peak coil current cutoff incorrect	-	C 7
				●					Primary voltage (EI control unit) incorrect	-	C 9
●									Power supply to EI control unit defective	-	D 1
●									Power supply to primary circuit defective	-	D 1
●									Starting signal (term. 50) incorrect	-	D 3
●									Engine-speed sensor (insulation, internal resistance, voltage) defective	-	D 5
●									Reference-mark sensor (insulation, internal reistance) defective	-	D 7

9.5 Trouble-shooting program

Test primary signal. If no oscilloscope or tachometer available, check whether ignition spark across spark gap.

Primary signal testing with oscilloscope
Connect oscilloscope to ignition coil as per operating instructions.
Start engine.
Oscilloscope must indicate a primary voltage (of any value).

Primary signal testing with tachometer
Connect tachometer to ignition coil as per operating instructions.
Start engine.
Tachometer must indicate a reading (of any value).

Ignition spark testing with spark gap
Remove H.T. igniton cable terminal 4 from ignition coil.
Connect spark gap including sleeve-type suppressor (5 kΩ) to ignition coil.
Adjust spark gap to 5 mm.
Start engine.
There must be sparks across the spark gap.

Primary signal present or ignition sparks across spark gap?

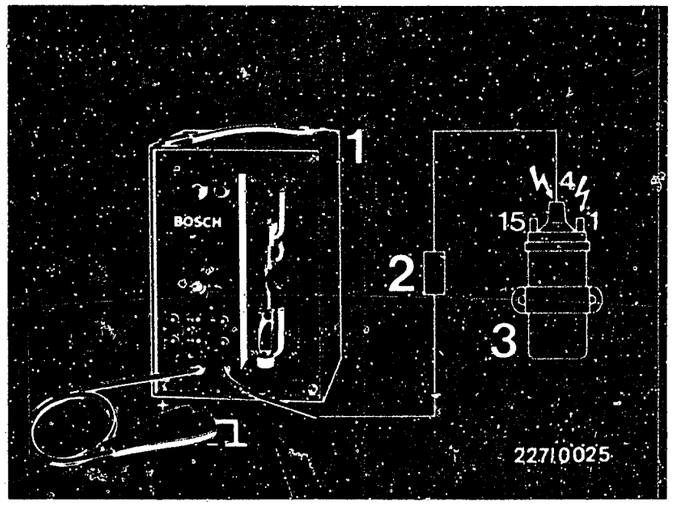
no →

If no primary signal or no ignition spark, continue testing at D 1.

Tests from B 11 onwards not necessary.

yes ↓

Continued on B 11/B 12



1 = Spark gap
2 = 5 kΩ sleeve-type suppressor
3 = ignition coil

Dangerous-voltage arrows:
Caution, 400 V ... 25 kV

Test distributor cap, distributor rotor, ignition leads and spark plugs.

High-tension side in order?

no → Repair high-tension side.

yes

Test the ignition coil.

Visual inspection:

Remove protective cap from ignition coil and check that plug is in position and that no sealing compoung has leaked.

Electrical test:

Ignition coil primary (term. 15 and 1)
0.6 ... 1.0 Ω (allow for resistance of test lead).
Ignition coil secondary (term. 1 and 4)
3.2 ... 5.6 kΩ.

Plug in position and no leaks of sealing compound?
Resistance values in order?

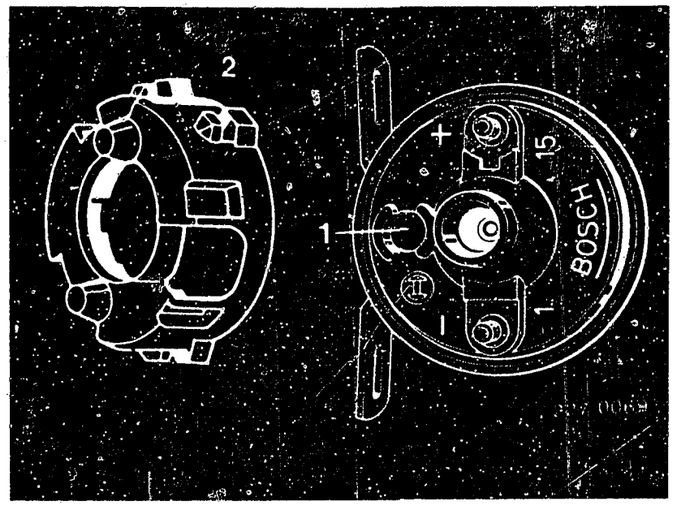
no →

1. If plug is not in position and/ or sealing compound has escaped, replace EI control unit and ignition coil.

2. If resistance values are not in order, replace ignition coil.

yes

Continued on B 13/B 14



1 = Plug
2 = Protective cap

Engine running?

no

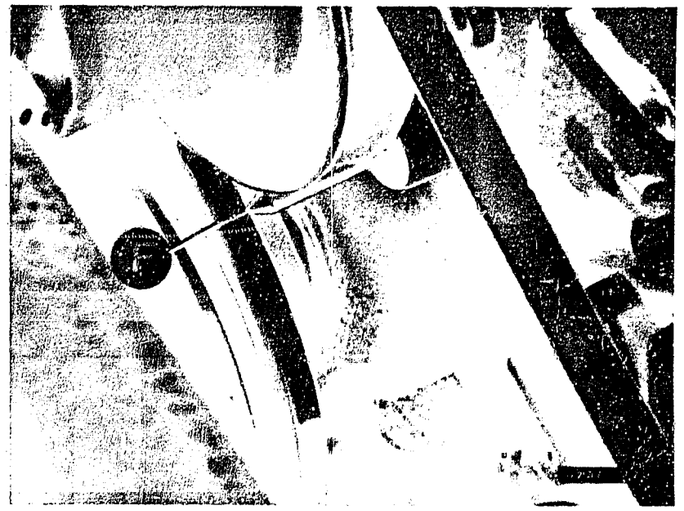
Test step 1

Remove cap and dust-protection cover from high-voltage distributor.

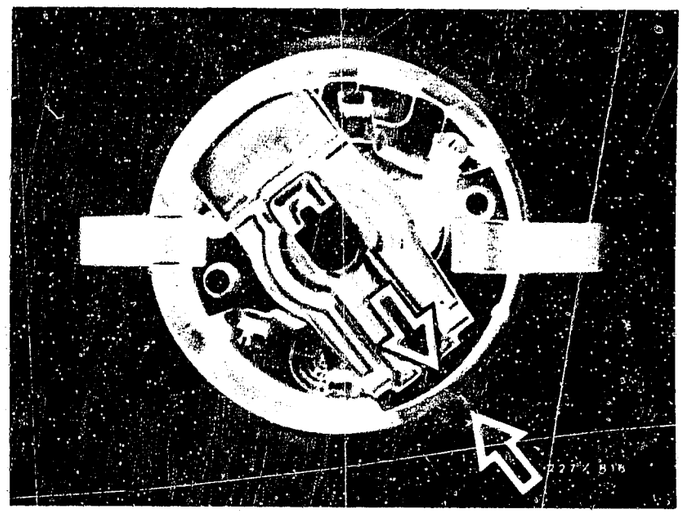
Set cylinder 1 (compression stroke) to mark "F". See upper illustration.

The distributor rotor must be positioned such that the center of the distributor rotor electrode points toward the mark on the housing for cylinder 1.
See arrows in bottom picture.

Adjust the ignition distributor.



yes



Continued on B 17/B 18

Continued on B 15/B 16

Continued

Test step 2

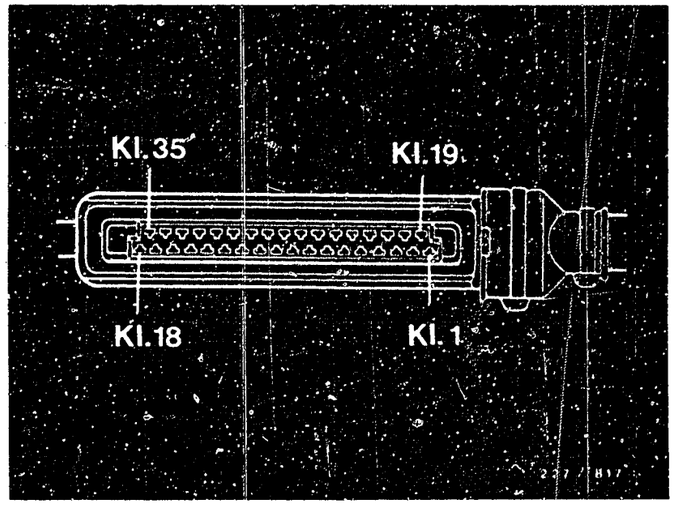
Disconnect negative and positive cables from battery. Remove EI control unit plug. Switch on ignition.

1. Check for contact resistance in cables from positive battery terminal to EI control unit plug terminal 10 including cables from negative battery terminal to EI control unit plug terminal 19. Total contact resistance max. 0.3Ω (take resistance of test lead into account).
Eliminate contact resistance.

2. Check for contact resistance in cables from positive battery terminal to ignition coil terminal 15 as well as in cable from ignition coil terminal 1 to EI control unit plug terminal 1. Total contact resistance max. 0.3Ω (take resistance of test lead into account).
Eliminate contact resistance.

If test steps 1 and 2 O.K., try installing specified ignition coil. If engine still not running, reinstall "old" ignition coil and replace EI control unit.

yes



EI control unit plug

Continued on B17/B18

Check coolant-temperature sensor.

Switch off ignition.
Remove EI control unit plug and connect ohmmeter to terminals 12 and 13.

See table for resistance values.

Coolant-temperature	Resistance values
+ 20°C	2.1 ... 2.9 kΩ
+ 30°C	1.4 ... 2.0 kΩ
+ 80°C	280 ... 370 Ω
+ 90°C	210 ... 280 Ω
+ 100°C	160 ... 215 Ω

Resistance value at given coolant temperature correct?

no

1. If ohmmeter indicates ∞Ω, remove coolant-temperature sensor plug. See lower illustration. Connect ohmmeter in turn to:

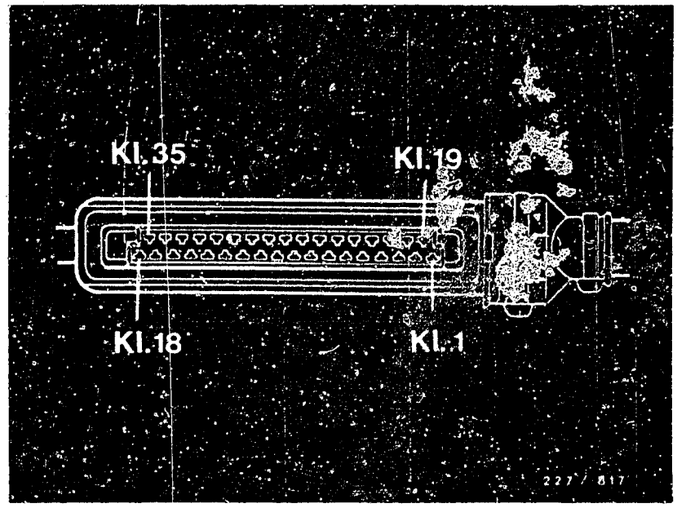
Coolant-temperature sensor plug	EI control unit plug
Term. 12	and term. 12
Term. 13	and term. 13

Ohmmeter must indicate approx. 0Ω (continuity).
Eliminate open circuit.

2. If resistance value not O.K., replace coolant-temperature sensor.

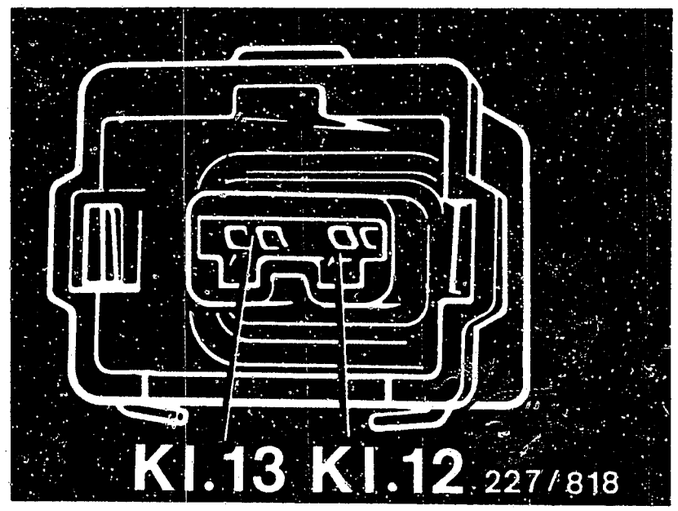
yes

Continued on B 19/B 20



EI control unit plug

Coolant-temperature sensor plug



Check <u>idle contact of throttle-valve switch</u>.

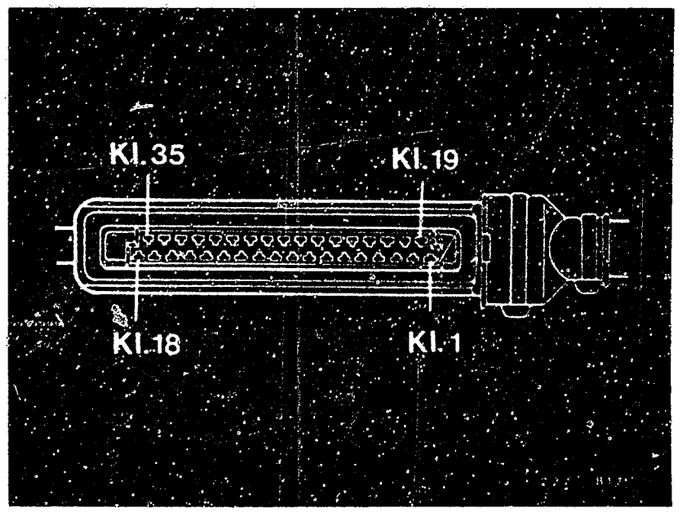
Switch off ignition.
Remove EI control unit plug and connect voltmeter to terminal 2 (+) and terminal 5. (-). See upper illustration.
Throttle valve in idle position.
Switch on ignition.
Voltmeter must indicate approx. 9 V.
Open throttle valve approx. 1°.
Voltmeter must indicate 0 V.

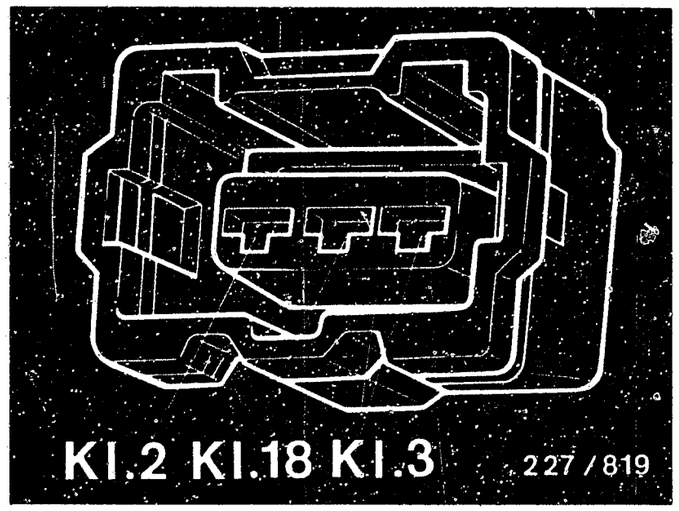
Voltages correct?

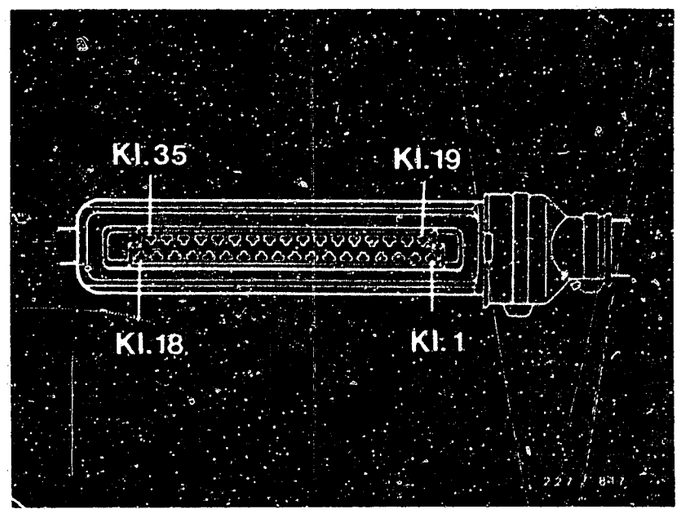
no →

1. Check for open circuit in cable from EI control unit plug term. 2 to throttle-valve switch plug term. 2 (center ill.) or in cable from throttle-valve switch plug term. 18 to L Jetronic control unit plug term. 18 (lower ill.).
Eliminate open-circuit.

yes







Continued on B 23/B 24

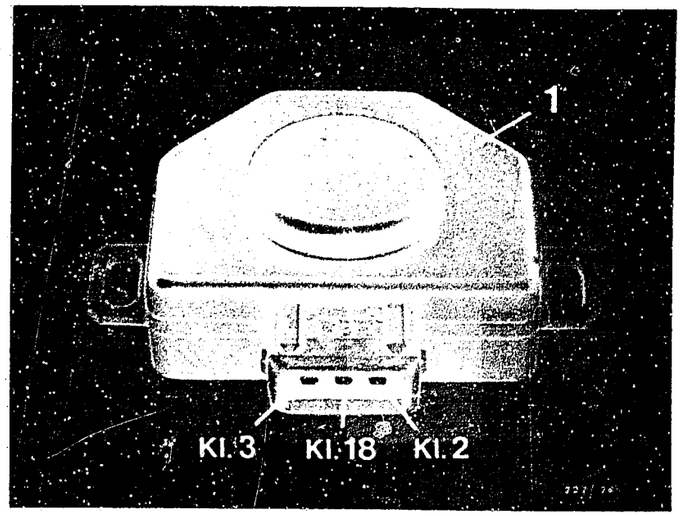
Continued on B 21/B 22

Continued

2. Connect ohmmeter to throttle-valve switch terminals 2 and 18.
Throttle valve closed. Resistance value approx. 0Ω.
Open throttle valve approx. 1°.
Ohmmeter must indicate ∞Ω.
If resistance value not O.K., adjust throttle-valve switch.

Procedure:
Slightly loosen fastening screws of throttle-valve switch. Turn throttle-valve switch until idle contact is closed.
Ohmmeter must indicate approx. 0Ω.
If approx. 0Ω not obtained, replace throttle-valve switch. Tighten fastening screws of throttle-valve switch.

Check:
Open throttle valve approx. 1°.
Ohmmeter must indicate ∞Ω.



Throttle-valve switch

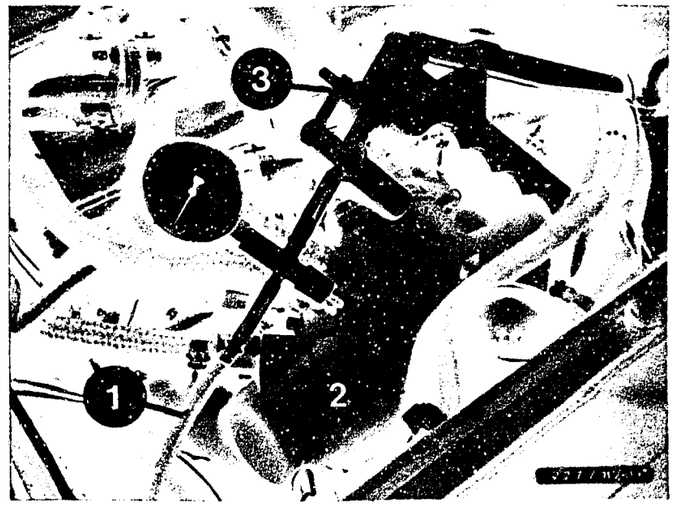
yes

Continued on B 23/B 24

Check vacuum sensor including hose connection, line for leaks.
Remove vacuum hose from intake manifold and connect vacuum pump. See upper illustration.
Build up vacuum of 600 mbar with vacuum pump. Pressure drop max. 150 mbar in 1 minute.
Leakage check O.K.?

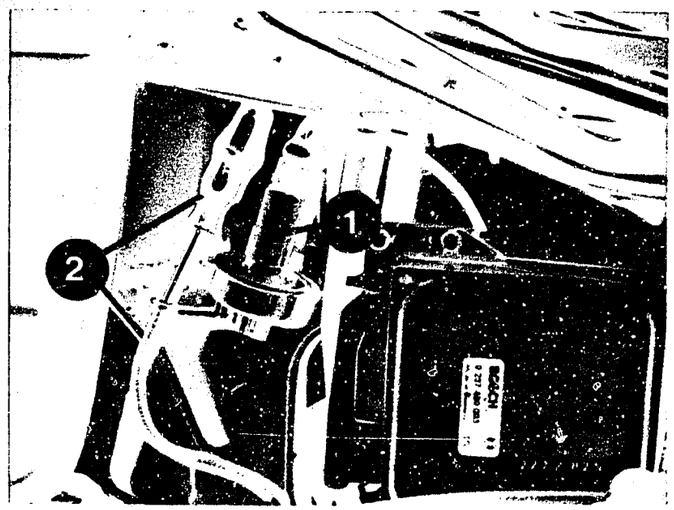
no →

1. Remove vacuum hose from vacuum sensor and seal hose tightly with e.g. screwdriver. See lower illustration.
Build up vacuum of 600 mbar. Repeat leakage check. Eliminate leaks (hose connection, line).
2. If there was no leak, replace vacuum sensor.



1 = Vacuum hose
2 = Vacuum connection
3 = Vacuum pump

yes



1 = Vacuum sensor
2 = Vacuum hose sealed

Continued on C 1/C 2

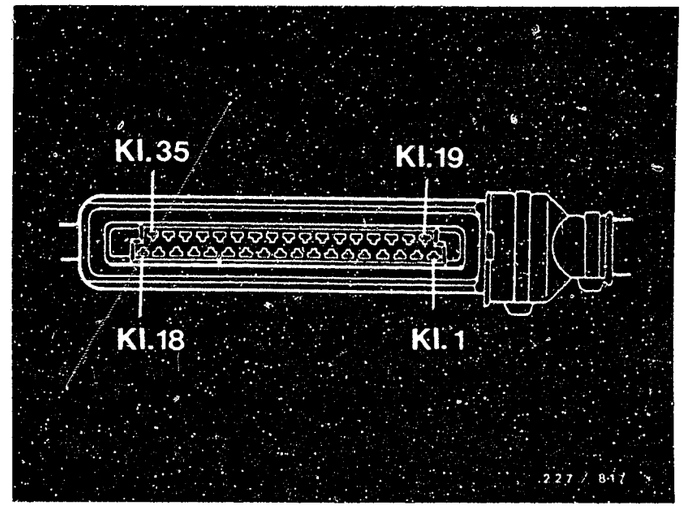
Check <u>vaccum-sensor insulation</u>.

Switch off ignition.
Remove EI control unit plug and connect ohmmeter to terminals 6 and 24. See upper illustration.
Ohmmeter must indicate ∞.
Resistance value O.K.?

no →

1. If resistance value is 0Ω, lead from control unit plug term. 24 to vacuum-sensor plug term. 24 has short circuit to ground. Eliminate short circuit to ground.

2. If resistance value is approx. 56Ω, lead from control unit plug to vacuum-sensor plug term. 7 has short circuit to ground. Eliminate short circuit to ground.



EI control unit plug

yes ↓

Check <u>vaccum-sensor internal resistance</u>.

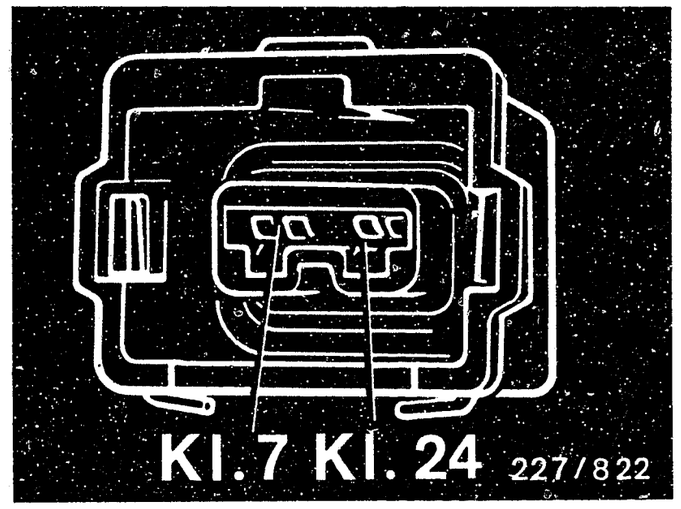
Connect ohmmeter to disconnected EI control unit plug terminals 7 and 24. Ohmmeter must indicate 50 - 60Ω. See upper illustration.
Resistance value O.K.?

no →

1. If ohmmeter indicates ∞, check for open circuit in leads from vacuum-sensor plug term. 7 and term. 24 to control unit plug term. 7 and term. 24. Eliminate open circuit.

2. If resistance value not O.K., replace vacuum sensor.

Vacuum-sensor plug



yes ↓

Continued on C 3/C 4

Check <u>spark advance</u>
Engine at operating temp. (coolant temperature > +60°C).

<u>Idle spark advance:</u> vacuum hose on intake manifold connected.

Engine speed min^{-1}	Spark advance in °crankshaft
900	10 ± 4

<u>Full-load spark advance:</u> disconnect vacuum hose from intake manifold.

Engine speed min^{-1}	Spark advance in °crankshaft
2000	16 ± 4

<u>Part-load spark advance:</u>
Connect vacuum pump to disconnected vacuum hose. Build up vacuum of 300 mbar with vacuum pump. See illustration.

Engine speed min^{-1}	Spark advance in °crankshaft
2400	30 ± 4

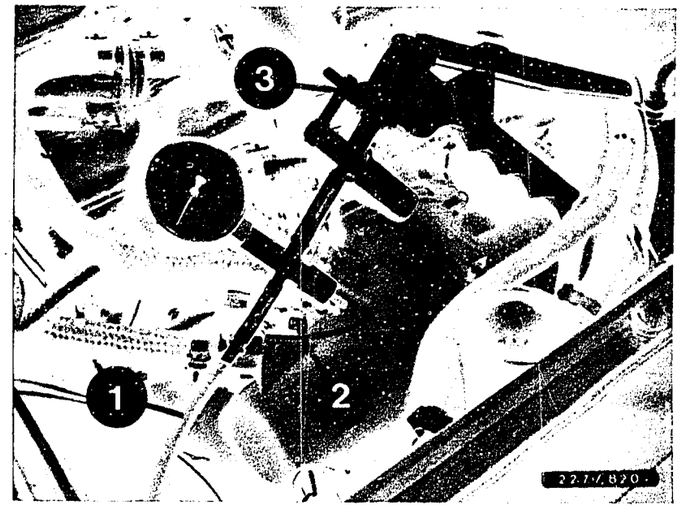
Spark advance correct?

no → Replace vacuum sensor. Repeat spark advance measurement.
If required values still not obtained, replace EI control unit.

<u>Reinstall "old" vacuum sensor.</u>

yes ↓

Continued on C 5/C 6



Check <u>power supply to ignition coil</u>.

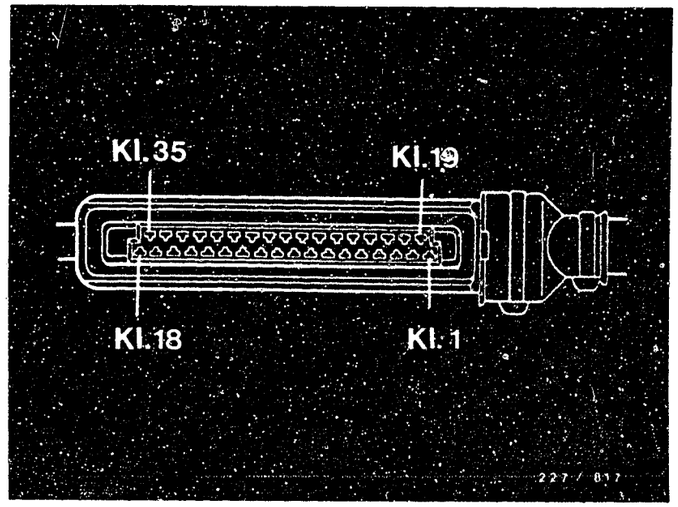
Connect voltmeter to ignition coil term. 15 and central ground (arrow, lower ill.).
Run engine at idle.
Voltage measured must be at least 10 V.
Voltage value correct?

no →

Disconnect negative and plus cables from battery.
Disconnect EI control unit plug. Switch on ignition.
Check for contact resistance in cables from positive battery terminal to EI control unit plug term. 10 as well as cables from negative battery terminal (via central ground - intake manifold) to EI control unit plug term. 19.
Total contact resistance max. 0.3Ω (take resistance of test leads into account).
Eliminate contact resistance.

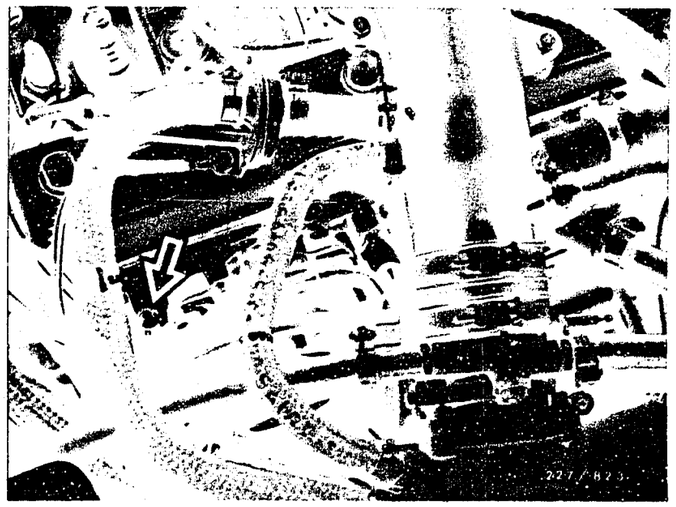
yes

Continued on C 7/C 8



EI control unit plug

Arrow = Central ground (intake manifold)



yes

Check peak coil current cutoff.
Connect voltmeter to ignition coil terminals 15 and 1. Switch on ignition.
The voltmeter may briefly deflect for approx. 1 s.
Voltmeter must return to 0 V.
Voltage value (0 V) correct?

no → Replace EI control unit and ignition coil.

yes

Continued on C 9/C 10

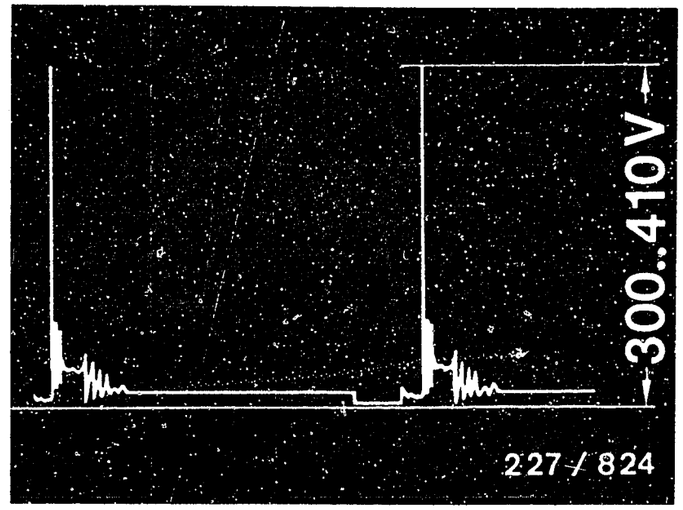
Check <u>primary voltage</u>.
(Where MOT series available).

Connect oscilloscope (e.g. MOT 201) together with pulse-shaping circuit 1 684 463 154 to ignition coil per operating instructions.
<u>Note:</u>
Incorrect reading will be obtained in absence of pulse-shaping circuit.

Run engine in idle. The measured primary voltage should be 300 ... 410 V. See illustration.

Voltage OK?

no → Replace EI control unit.



yes ↓

If all test steps O.K. and customer complaint is still not remedied, try installing specified ignition coil.
If customer complaint is still not remedied, reinstall "old" ignition coil.
<u>Ignition system O.K.</u>
<u>Test ended</u>
Tests D 1 onward no longer necessary.

<u>Remark:</u>
Possible further causes of trouble in fuel system or engine not mechanically O.K.

Trouble-shooting program if no primary signal or ignition spark present.

(Continuation from B9/B10)

yes

Check power supply to EI control unit.
Switch off ignition.
Disconnect EI control unit plug and connect voltmeter to term. 10 (+) and term. 5 (-).
Switch on ignition.
Voltmeter must indicate battery voltage.

no → Check for open circuit in leads and connections from ignition and starting switch to EI control unit plug terminal 10 as well as ground cable terminal 5.
Eliminate open circuit.

yes

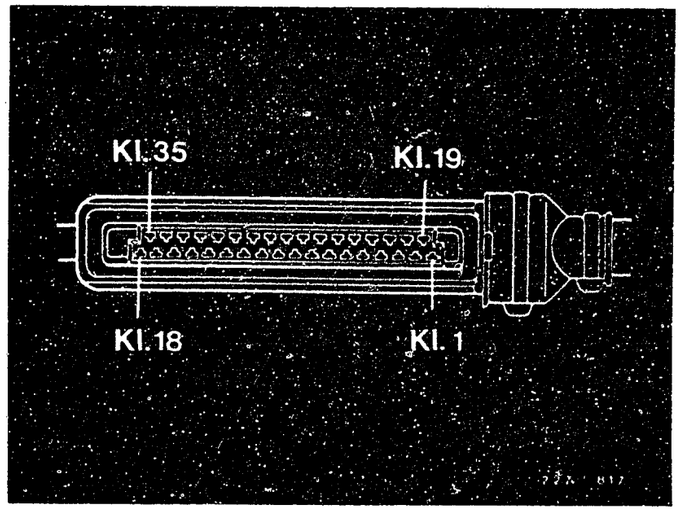
Check power supply of primary circuit.
Switch off ignition.
Remove EI control unit plug and connect voltmeter to terminal 1 (+) and terminal 19 (-). Switch on ignition.
Voltmeter must indicate battery voltage.

Voltage value correct?

no → Check for open circuit in instrument lead from ignition and starting switch to ignition coil term. 15, primary winding of ignition coil as well as lead from ignition coil term. 1 to EI control unit plug term. 1 including ground cable term. 19.
Eliminate open circuit.

yes

Continued on D 3/D 4



EI control unit plug

Check <u>starting signal</u>.

Switch off ignition.
Disconnect EI control unit plug and connect voltmeter to term. 4 (+) and term. 5 (-).
Start engine.
Voltmeter must indicate battery voltage.
Voltage value correct?

no → Check for open circuit in lead from ignition and starting switch term. 50 to EI control unit plug term. 4.

Eliminate open circuit.

yes

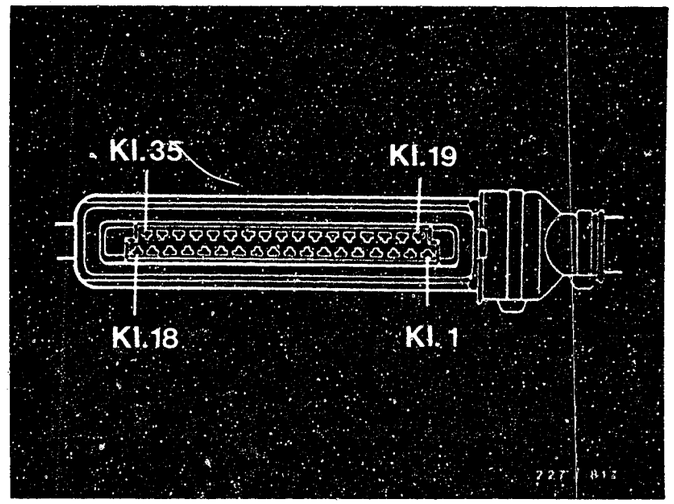
Check <u>insulation of engine-speed sensor</u>.
Switch off ignition.
Disconnect EI control unit plug and connect ohmmeter to term. 8 and term. 11.
Ohmmeter must indicate ∞Ω.
Resistance value O.K.?

no → 1. If resistance value approx. 0 Ω, lead from EI control unit plug term. 8 to engine-speed sensor plug term. 8 has short circuit to ground. Eliminate short circuit to ground.

2. If resistance value approx. 1kΩ, lead from EI control unit plug term 27 to engine-speed sensor plug term. 27 has short circuit to ground. Eliminate short circuit to ground.

yes

Continued on D 5/D 6



EI control unit plug

Check internal resistance of engine-speed sensor.
Switch off ignition.
Disconnect EI control unit plug. Connect ohmmeter to term. 8 and term. 27.
Ohmmeter must indicate 0.6 ... 1.6 kΩ.
Resistance value O.K.?

no →

1. If ohmmeter indicates ∞Ω, check for open circuit in lead from engine-speed sensor plug term. 8 and term. 27 to EI control unit plug term. 8 and term. 27.
Eliminate open circuit.

2. If resistance values not O.K., replace engine-speed sensor.

yes ↓

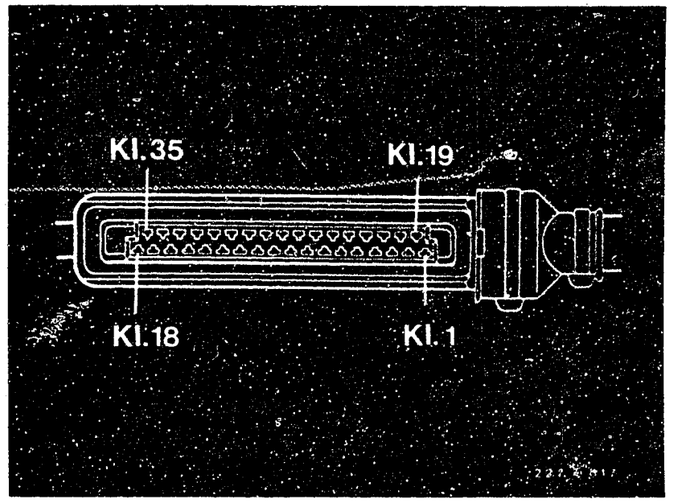
Check voltage of engine-speed sensor.

Switch off ignition.
Disconnect EI control unit plug.
Connect oscilloscope in program-selector-switch position "Special" as per operating instructions.
For example, MOT 201:
connect red and black terminal at disconnected EI control unit plug term. 8 (+) and term. 27 (-).
Start engine (cranking speed > 200 min^{-1}).
Oscilloscope must indicate a voltage of at least 2.5 V. See lower illustration.
Voltage correct?

no → Replace engine-speed sensor.

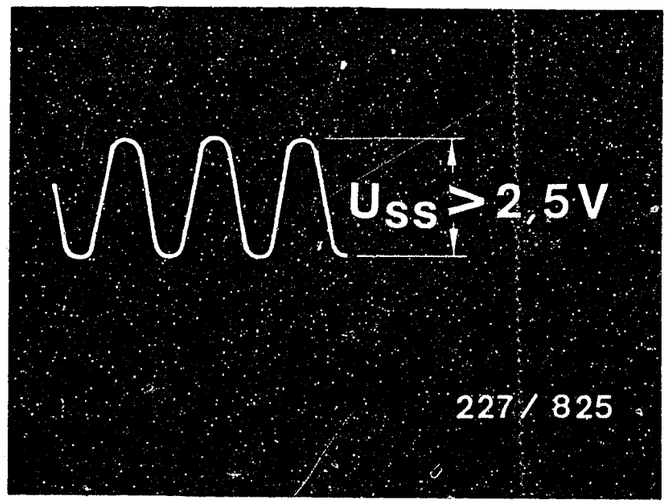
yes ↓

Continued on D 7/D 8



EI control unit plug

Engine-speed sensor signal



Check <u>insulation of reference-mark sensor</u>.
Switch off ignition.
Disconnect EI control unit plug and connect ohmmeter to term. 6 and term. 25.
Ohmmeter must indicate ∞Ω.

Resistance value O.K.?

no →

1. If resistance value is approx. 0 Ω, lead from EI control unit plug term. 25 to engine-speed sensor plug term. 25 has short circuit to ground.
Eliminate short circuit to ground.

2. If resistance value is approx. 1 kΩ, lead from EI control unit plug term. 26 to engine-speed sensor plug term. 26 has short circuit to ground.

Eliminate short circuit to ground.

yes ↓

Check <u>internal resistance of reference-mark sensor</u>.
Switch off ignition.
Remove EI control unit plug and connect ohmmeter to term. 25 and term. 26.
Ohmmeter must indicate 0.6 ... 1.6 kΩ.

Resistance value O.K.?

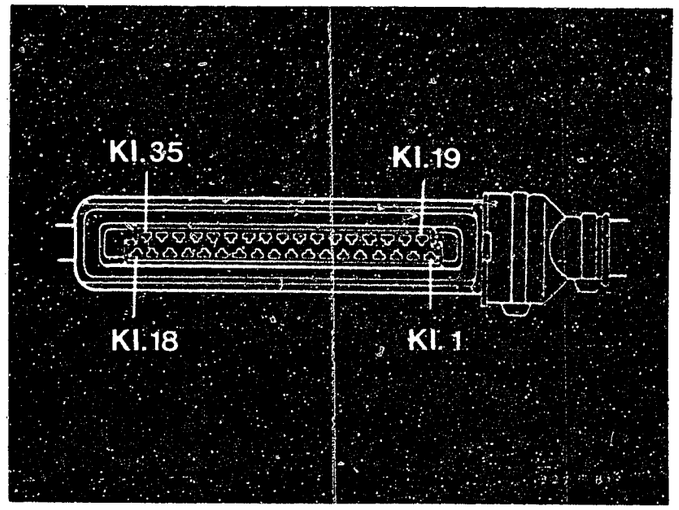
no →

1. If ohmmeter indicates ∞Ω, check for open circuit in lead from engine-speed sensor plug term. 25 and term. 26 to EI control unit plug term. 25 and term. 26.
Eliminate open circuit.

2. If resistance value not O.K., replace reference-mark sensor.

yes ↓

Continued on D 9/D 10



EI control unit plug

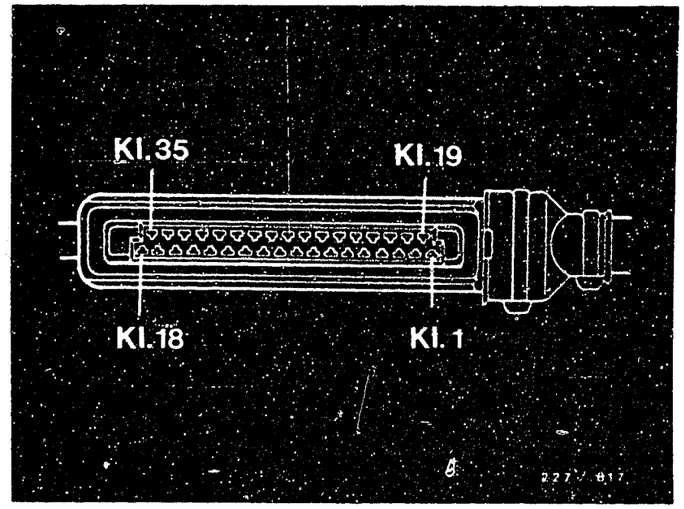
yes

Check voltage of reference-mark sensor.
Switch off ignition.
Disconnect EI control unit plug.
Connect oscilloscope in program-selector-switch position "Special" as per operating instructions.
For example, MOT 201:
connect red and black terminal at disconnected EI control unit plug term. 25 (+) and term. 26 (-).
Start engine.
(Cranking speed > 200 min^{-1}).
Oscilloscope must indicate a voltage of at least 2.5 V.
See lower illustration.
Voltage correct?

no → Replace reference-mark sensor.

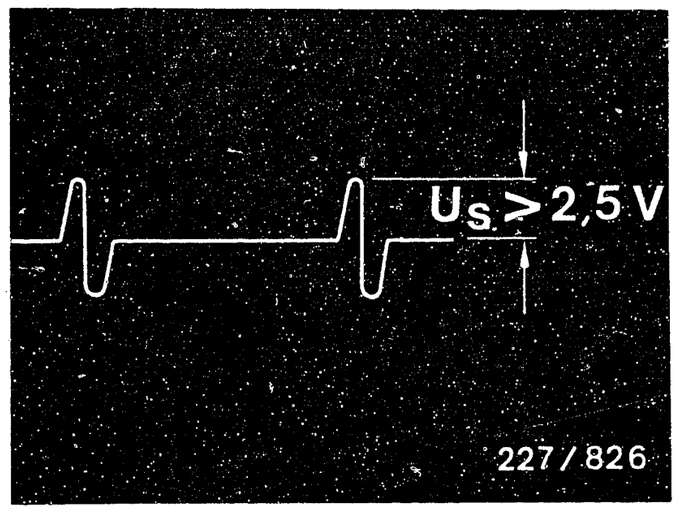
yes

Continued on D 11/D 12



EI control unit plug

Reference-mark sensor signal



yes

Test ignition coil.

Visual examination:
Remove protective cap from ignition coil and check whether plug (see picture) is in position and whether any sealing compound has escaped.

Electrical test:
Ignition coil primary (term. 15 and term. 1) 0.6 ... 1.0 Ω (make allowance for resistance of test lead).

Ignition coil secondary (term. 1 and term. 4) 3.2 ... 5.6 kΩ.

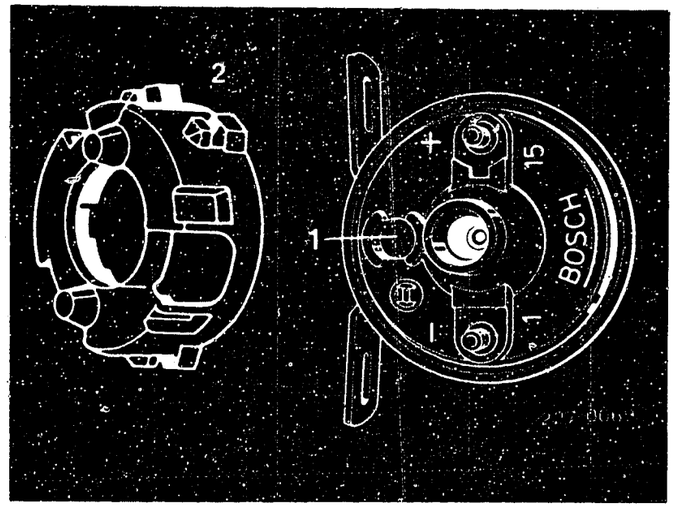
Plug in position? No sealing compound escaped?

Resistance value O.K.?

no

1. If plug is not in position and/or sealing compound has escaped, replace EI control unit and ignition coil.

2. If resistance values are not O.K., replace ignition coil.



1 = Plug
2 = Protective cap

yes

If all test steps O.K. and primary signal or ignition spark still not present, then try installing specified ignition coil.
If primary voltage or ignition spark still not present, then reinstall "old" ignition coil and replace EI control unit.

Test ended.
Tests B 11 onward not necessary.
Remark:
Possible further causes of trouble in fuel system or engine not mechanically O.K.

After-sales Service

Technical Bulletin

22

Danger of Accident on Semi-conductor Ignition Systems

VDT-I-227/102 B

11.1976

Please be sure to pass this bulletin on to your employees for their attention.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led some time ago to manufactures starting to equip their vehicles with semi-conductor ignition systems as original equipment. In most cases the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" parts or contacts (whether on the primary side or the secondary side) can prove fatal.

In this connection we should like to point out to you that the laws valid in your country regarding work on high-voltage systems must be adhered to when working on, or testing, semi-conductor ignition systems.

As a matter of principle, when working on such ignition systems the ignition is to be switched off. Included in such work are the following operations:

- Connection of engine testing equipment (timing light, dwell-tach tester, ignition oscilloscope etc.).
- Replacement of ignition system parts (spark plugs, ignition coil, ignition distributor, H.T. ignition cables etc.).

If it is necessary to switch on the ignition in order to test the system or make adjustments on the engine (to the carburetor for instance), then lethal voltages are present throughout the entire system.

This means that the danger of accident exists not only at individual components in the system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also at the wiring harness (e.g. connection for the tachometer, diagnostic connector), on terminals, and on test equipment.

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Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung
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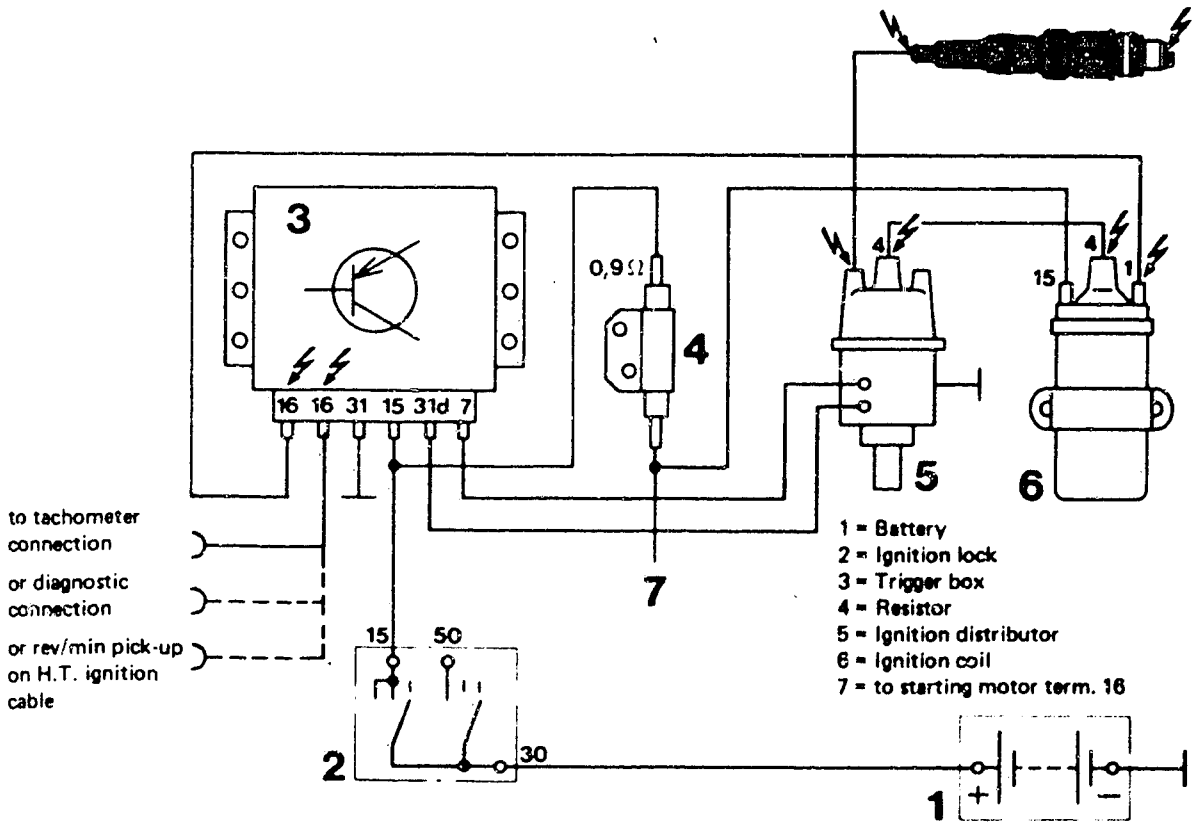
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

In addition, in the case of the capacitor-discharge ignition system (CDI), danger of accident is also present under the following circumstances:

- Operation of the trigger box without the ignition transformer.
- At the trigger box, (removed), relatively soon after it has been switched off (capacitor discharge).

Below is a typical terminal diagram of a semi-conductor ignition system, the danger points are marked with red high-voltage arrows. We would point out that all semi-conductor ignition systems, even the older ones, are to be regarded as dangerous in the sense as defined by this bulletin.

Please address any queries or comments concerning the contents of this publication to our representative in your country.



Terminal diagram

After-sales Service

Technical Bulletin

EFFECTS OF ELECTRICAL AND ELECTRONIC SYSTEMS ON HEART PACEMAKERS

e.g. ignition systems, Jetronic, Motronic, ABS

VDT-I-227/107 En

1.1981

Please ensure without fail that this Bulletin is passed on to your employees for their attention!

We have often been asked by some of our customers whether or not patients with heart pacemakers are endangered in any way by ignition systems. This theme was recently the subject of an examination carried out by the Ignition System Development Department of Robert Bosch GmbH in conjunction with Dr. Thull, lecturer at the Central Institute for Biomedical Technology at the University of Erlangen-Nürnberg and Biotronic GmbH & Co. of Berlin, a manufacturer of heart pacemakers. The magazine "Biomedizinischen Technik" (5/80) listed the results.

The most important discoveries in this practice can be summarized from the examination report as follows:-

1. Heart pacemakers corresponding to the latest state of the art are not affected by radiation (electromagnetic fields) from ignition systems.
2. With a stationary engine and the ignition switched off the heart pacemaker is not affected by any part of the ignition system, even when unintentionally touched. Maintenance work in the engine compartment, for example, can then be carried out without any danger.
3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can here be affected under certain conditions (voltage, current and frequency).
   Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.
4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers please carry out the necessary measures.

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We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.

After-sales Service

Technical Bulletin

NEW DESIGNATIONS FOR IGNITION SYSTEMS

VDT-I-227/108 En
1.1983

The introduction of new ignition systems has made it necessary to reclassify all designations.

The designations listed below will be used immediately in KH workshop and sales literature.

Designation	Abbrev'd code	Meaning	Switching	Ignition control and spark advance	High-voltage distribution
Coil ignition	SZ (CI)	---------	Mechanical (breaker points)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistor-ized coil ignition	TSZ-K (TCI-c)	K=breaker-triggered	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Trigger box with conventional circuit techniques	TSZ-I* (TCI-i)	I=Induction-type pulse generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
	TSZ-H	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistor-ized ignition	TZ-I* (TI-i)	I=Induction-type pulse generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
(Trigger box in Hybrid technique)	TZ-H* (TI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)

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Designation	Abbrev'd code	Meaning	Switching	Ignition control and spark advance	High-voltage distribution
Breakerless semiconductor ignition with or without knock control	EZ EZ-K	- K=Knock control	Electronic (trigger box or control unit)	Electronic (control unit)	Mechanical (ignition distributor or high-voltage distributor)
Distributor-less ignition with or without knock control	VZ VZ-K	- K=Knock control	Electronic (control unit)	Electronic (control unit)	Electronic (dual-spark ignition coil, or 1 ignition coil for each spark plug)

*Note: The ignition system can also be equipped with a DLS unit (digital idle stabilization) or with an ELS unit (electronic idle stabilization) or with an ESV unit (electronic ignition retardation).

After-sales Service

Motor Vehicle Service Information

INCORRECT DISPLAY OF ROTATIONAL SPEED AND DWELL ANGLE ONLY WITH TRIGGER BOXES 0 227 100 ... (TCI-i, TCI-h) WITH CURRENT LIMITATION

VDT-I-Gen. 030 En
6.80
Supersedes Ed. 3.80

For additional information see VDT-I-Gen. 032 En

1. General

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle when testing the ignition system. However, there is no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Incorrect displays may occur with the testers listed below:

MOT	001.00 001.01 001.02 001.04 002.00	Rotational-speed display O.K. with these testers	KTE	001.00 001.02 001.03

By now, the following vehicles may be fitted with breakerless ignition systems with current limitation:

Audi	(Bosch/Fairchild-ignition system)	Mazda	(Mitsubishi ignition system)
BMW	(Bosch ignition system)	Mitsubishi	(Mitsubishi ignition system)
Citroen	(Delco ignition system)	Nissan-Datsun	(Hitachi ignition system)
Fiat	(Delco ignition system)	Peugeot	(Bosch ignition system)
Ford	(Delco ignition system)	VW	(Bosch/Fairchild ignition system)
General-Motors	(HEI-ignition system)	Bosch transistorized ignition system for retrofitting 0 227 100 920	

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2. Test instructions

2.1 Rotational speed

Incorrect rotational-speed display can be recognized as follows:

If one starts at the idle speed and slowly increases the engine speed, then the incorrect display can be recognized by an abrupt reduction in the rotational-speed display (e.g. from 2400 min^{-1} to 1200 min^{-1}).

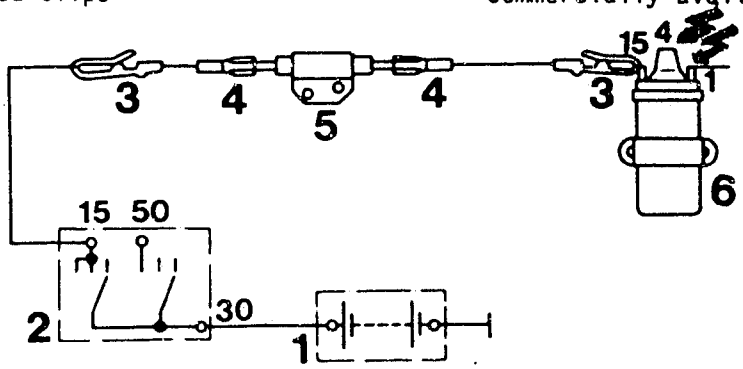
It is, however, possible to attain correct rot.-speed measurements as follows:

Connect a ballast resistor of 0.9 or 1.0 Ohm (see Fig.) in series in the line to term. 15 of the ignition coil (take care not to cause a short circuit). After the rotational-speed measurement, the ballast resistor must be removed (otherwise starting difficulties and misfiring). Connect tester as per operating instructions.

Suggestion for user manufacture

Required parts:

1 ballast resistor 0.9 Ohm	Part No. 0 227 900 002
or	
1 ballast resistor 1.0 Ohm	Part No. 0 227 900 101
2 blade receptacles e.g.	Part No. 1 901 355 881
approx. 0.2 m cable, 1.5 mm^2 e.g.	Part No. 6 210 150 150
2 insulated clips	Commercially available



1 = Battery
2 = Ignition switch
3 = Clips
4 = Blade receptacle
5 = Ballast resistor
6 = Ignition coil

ϟ approx. 400 V

ϟ approx. 25 kV

2.2 Dwell angle

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

2.3 Ignition point

Is displayed correctly. Connect tester as per operating instructions.

After-sales Service

Motor Vehicle Service Information

MOTORTESTER CONVERSION
Incorrect display of rotational speed, dwell angle and ignition point only with trigger boxes 0 227 100 ... (TCI-i, TCI-h) with current limitation

VDT-I-Gen. 032 En
6.80

For additional information see VDT-I-Gen. 030 of 6.80

Re.: Motortester EFAW 268
268 S 10
269
214 B
AE 2000

1. General

Please make sure that the above-mentioned motortesters in your workshop and at your customers (e.g. motor vehicle workshops, oil companies, gas stations, vocational schools etc.) are converted. The conversion is subject to payment and is carried out by the K7 after-sales service of the responsible BG. The standard time is 15 work units (with fitting of switch).

2. Why motortester conversion?

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle as well as to incorrect triggering of the meter when testing the ignition system. There is, however, no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Since, with the above-listed motortesters, the timing light is triggered by the signal path dwell angle - meter, this incorrect triggering also leads to incorrect flashing and thus to an incorrect display of the advance angle.

3. Conversion measures

The situation is to be remedied by modifying the wiring of the testers so that the timing light is triggered by the clamp-on induction pickup and the pulse shaper stage.

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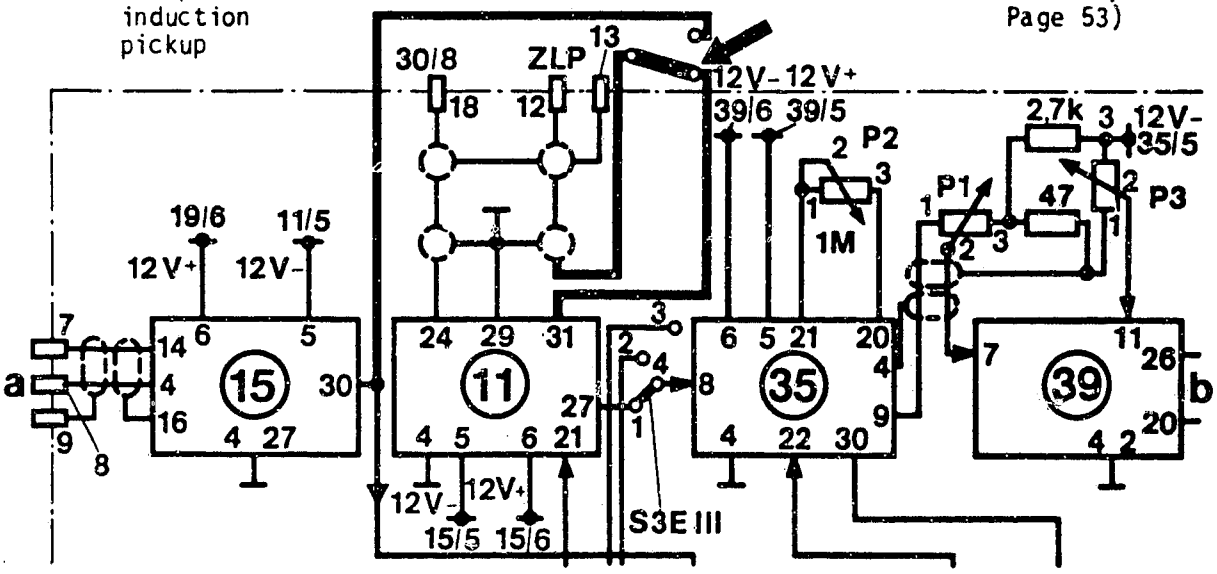
EFAW 268, 268 S 10, 269, AE 2000

Remove the line of the ZLP* from pin 31 of printed board 11 (coupling stage) and connect to pin 30 of printed board 15 (pulse shaper stage) via a switch with change-over contact (e.g. 0 341 500 803). In addition, a new line must be connected from pin 31 of printed board 11 to the other contact of the switch with change-over contact. Arrow points to switch with change-over contact.

* ZLP = timing light

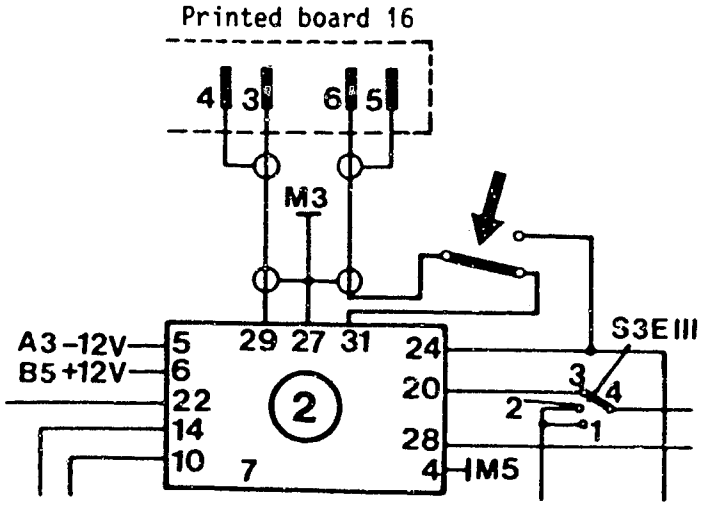
a = Clamp-on induction pickup

b = (Extract from WJF 508/1 Page 53)



EFAW 214 B

Remove the line from terminal 6 of printed board 16 to pin 31 of printed board 2 (coupling stage) and connect to pin 24 of the same printed board via a switch with change-over contact (e.g. 0 341 500 803). In addition, a new line must be connected from pin 31 of printed board 2 to the other contact of the switch with change-over contact. Arrow points to switch with change-over contact.



(Extract from WJF 503/1, Page 64)

By fitting the switch with change-over contact in the front panel of the motor-tester, it is possible to switch over from standard ignition systems to those with current limitation. We recommend that the switch positions be marked correspondingly: e.g. "standard" - "current limitation".
These conversion measures have already been published in the K7 information sheet KJF 28/7911.

4. Test instructions

4.1 Standard ignition systems

Switch position: "standard"
All other tester connections as per operating instructions.

4.2 Ignition systems with current limitation

Switch position: "current limitation"

In order to trigger the timing light, the induction-type pulse generator (clamp-on pickup or red pickup) must always be connected during the measurement.

The selector switch for ignition systems built into the motortester must be switched to standard coil ignition (not to TCI) with these ignition systems.

All other tester connections as per operating instructions.

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

After-sales Service

Motor Vehicle Service Information

TESTS ON ELECTRONIC IGNITION SYSTEMS
(TCI, TZ)
TESTER INSTRUCTIONS

VDT-I-Gen. 035 En
3.1981

The following tests are listed in older and current Tester operating instructions or in Trouble-shooting with the oscillograph.:

- "Separate ignition coil test" (concerns EFAW 213, 214, 268, AE 2000).
- Calculating the "ignition voltage reserve" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).
- "Intensified insulation test" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).

Nowadays transistorized ignition systems deliver more than 30,000 V secondary voltage.

To avoid damage to ignition coil, ignition cable and ignition distributor by voltage flashovers, the tests listed above should not be carried out on transistorized ignition systems.

The contents of this Service Information has already been published in the K7-Information K7-VJF 17/8012.

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung

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